10^{th} Laboratory Exercise

Inclined plane

Theoretical part

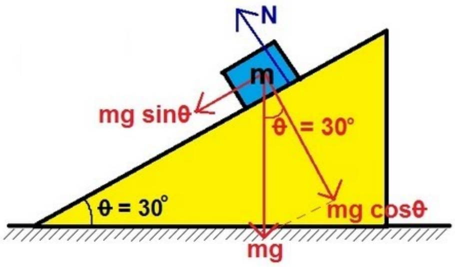

Figure 1

Our main goal is to calculate the work needed to pull a body towards an inclined plane. As you can see in Figure 1, when a body with mass m is left on an inclined plane the weight force mg is analyzed into two different components mgsinθ and mgcosθ. Also, on Figure 1 the perpendicular force N is denoted. We have chosen a typical angle of 30 degrees for the inclination of the lane. The question is why its preferable for a workman to pull a box towards an inclined plane, instead of a perpendicular direction. Furthermore, can we propose a workman the best angle for an inclined plane in order not to be tired.

Experimental part

Instruments, apparatus and materials:

1. An inclined wooden plane
2. Several different weights
3. A dynamometer
4. A pulley on the top of the inclined lane
5. A moving cylinder and a body both attached via a string to the dynamometer.
6. Protractor

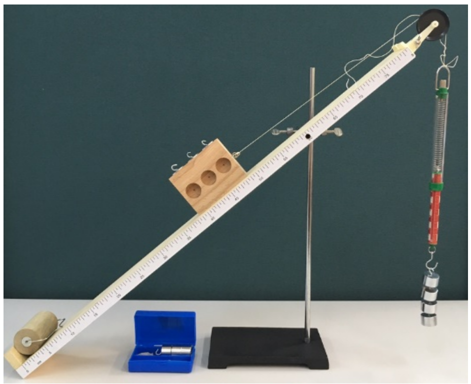

Figure 2

The experimental Apparatus is being shown in Figure 2. We can also see that a ruler is being attached on the side of the inclined plane so we can measure the displacement of a body while moving on the inclined plane.

Experimental procedure:

First of all, by using the digital weighter, measure the mass of the cylinder and the calculate the weight. Secondly, by using the protractor set an initial value of the angle of the inclined plane at 15 degrees. We place the wooden cylinder on the inclined plane and on the other side of the dynamometer we are placing weights until the cylinder is balanced. Continuously, we change the angle into 30 degrees and again try to balance the cylinder. The same with 45,60 and 75 degrees. While performing the experiment fill the following Table 1. We record each time the weight needed to ensure the balance of the cylinder on the inclined plane.

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Table 1

Angle (degrees)	Cylinder mass m (Kg)	Cylinder Weight mg (N)	mgsinθ	Weight dynamometer (Kg)
15				
30				
45				
60				
75				

- By using the values of Table 1 plot a graph of the Weights vs the applied angle.
- What are you noticing?
- Which are your conclusions?
- What would happen for 90 degrees, or 0 degrees.
- What would you recommend to a workman trying to pull a heavy box on a higher level?

B. Now assume that the cylinder is moving upwards the inclined plane. Place an extra weight to the end of the dynamometer and let the cylinder move upwards. Add in all different angles the same extra weight.

Calculate the work for a specific displacement. The formula for the work is $W=F*\Delta x*\cos\theta$, F is the Force, Δx is the displacement and θ the angle between the force and the displacement.

- What are you observing from the calculation of the work in each different angle?
- What would you recommend to a workman as far as concerns the work he would consume pulling a heavy object on an inclined plane?

- Fill the following Table 2

Table 2

Angle (degrees)	Weight comonent mgsinθ (N)	Weight dynamometer (Kg)	Work needed to pull the cylinder W (J)
15			
30			
45			
60			
75			